Patent claims

1. Component operating with surface-proximal acoustic waves, with the features:

- at least three interdigital transducers are arranged on the surface of a piezoelectric substrate, said interdigital transducers being respectively provided with a first and a second electrical connection and being electrically circuited with one another via these connections, whereby the interdigital transducers are selected from serial and parallel interdigital transducers (IS, IP),
- at least one serial interdigital transducer (IS1, IS2) is arranged in at least one serial branch serving as a signal path, said branch connecting the input and the output of the component and in which all elements contained therein are electrically connected in series,
- at least one parallel branch in which is arranged a parallel interdigital transducer (IP) is connected parallel thereto against a reference potential,
- at least one of the serial or parallel interdigital transducers (IS, IP) is arranged in series with a further interdigital transducer in the propagation direction of the acoustic wave, such that both interdigital transducers are acoustically coupled with one another, whereby the transducers coupling with each other differ from eachother by at least one of the following features:
  a) the interdigital transducers possess a different aperture
  b) the interdigital transducers possess a different pitch
  c) the interdigital transducers belong to different branches of the component
  d) of the interdigital transducers, at least one is arranged in the serial branch and the transducers are not directly electrically connected with one another
  e) the interdigital transducers comprise a different number of interdigital electrode fingers

f) the interdigital transducers exhibit a different metallization thickness

g) the interdigital transducers are weighted and exhibit a different weighting.

2. Component according to claim 1,
in which both coupled interdigital transducers are arranged in a serial branch.

3. Component according to claim 1 or 2,
in which a metallized delay line or a reflector structure is arranged between the two interdigital transducers.

4. Component according to claim 2,
in which both coupled interdigital transducers are arranged in the same serial branch, and in that both terminal electrode fingers adjacent to one another of the coupled interdigital transducers are respectively connected with those current rails of the interdigital transducers that exhibit the lowest potential difference relative to one another.

5. Component according to any of the claims 1 through 4,
in which at least two serial interdigital transducers following in succession in the circuiting in the serial branch are arranged next to one another transverse to the propagation direction of the acoustic surface wave and thus form a cascade, and in which one of these interdigital transducers is acoustically coupled with a further interdigital transducer.

6. Component according to claim 5,
in which two interdigital transducers coupled with one another are arranged in one and the same cascade.

7. Component according to claim 6,

in which a plurality of interdigital transducers of one cascade are acoustically coupled with a corresponding number of further interdigital transducers arranged in a different cascade.

8. Component according to any of the claims 1 through 7, in that at least three serial interdigital transducers arranged next to one another are part of a cascade, in which the three interdigital transducers are acoustically coupled, in which both outer interdigital transducers are circuited parallel to one another and respectively in series relative to the center interdigital transducer.

9. Component according to any of the claims 1 through 8,
in which two serial interdigital transducers are coupled that are not arranged one directly after the other in the series circuit, and between which in the circuiting in the serial branch is arranged at least one further acoustically uncoupled interdigital transducer.

10. Component according to any of the claims 1 through 9,
in which the two acoustically coupled interdigital transducers (IS1, IS2; IP1, IP2) are separated from one another via an acoustically transmissive intermediate reflector (ZR) that comprises a number of n reflector stripes, whereby n is a positive natural number with $1 \leq n \leq 100$.

11. Component according to any of the claims 1 through 10,
- in which at least two serial interdigital transducers (IS1, IS2) are provided and acoustically coupled with one another
- in which at least two parallel branches are provided, each with a parallel interdigital transducer (IP1, IP2), whereby both parallel interdigital transducers are acoustically coupled.

12. Component according to any of the claims 1 through 11,

in which two parallel interdigital transducers (IP) are provided that are part of a DMS filter.

13. Component according to any of the claims 1 through 12, in that in the serial branch a DMS structure is arranged that is acoustically coupled with at least one serial interdigital transducer (IS).

14. Component according to any of the preceding claims, in which all serial interdigital transducers (IS) are arranged in a common serial track (S) and all parallel interdigital transducers (IP) are arranged in a common parallel track (P).

15. Component according to any of the claims 1 through 14, in which the aperture of the parallel track (P) is larger than that of the serial track (S).

16. Component according to claim 15, in which the aperture of the serial track (S) is at least 15λ large, whereby λ is the acoustic wavelength at center frequency of the component.

17. Component according to any of the claims 1 through 16, in which the two interdigital transducers acoustically coupled with one another exhibit the same finger period, however are displaced against each other by an amount Δx, with $-0.25 < \Delta x/\lambda < 0.25$, whereby λ is the acoustic wavelength at center frequency of the component.

18. Component according to any of the claims 1 through 17, in which the finger period of the parallel interdigital transducers (IP) is larger than that of the serial interdigital transducers (IS).

19. Component according to any of the claims 1 through 18,

in which further elements selected from one-port resonators and DMS tracks are connected serially to the serial interdigital transducers (IS).

20. Component according to any of the claims 1 through 19, in which further elements selected from one-port resonators and DMS tracks are connected serially to the parallel interdigital transducers (IP).

21. Component according to any of the claims 1 through 20, in which at least one part of the electrical connections between the interdigital transducers (IS, IP) or between the interdigital transducers and input or output, or between the interdigital transducers (IS, IP) and the electrical ground are realized as discrete elements selected from capacitors, delay lines, resistors, inductors, bond wires, bumps or other suitable connection elements.

22. Component according to any of the claims 1 through 21, in which, viewed over the length of the interdigital transducer or reflector, the finger period varies within an interdigital transducer (IP, IS) or a reflector (RS, RP).

23. Component according to any of the claims 1 through 21, in which, viewed over the length of the interdigital transducer or reflector, the metallization ratio varies within an interdigital transducer (IP, IS) or a reflector (RS, RP).

24. Component according to any of the claims 22 or 23, in which the actual values for metallization ratio or finger period vary maximally +/- 3% around an average value.

25. Component according to any of the claims 22 through 24,

in which, viewed over the length of the interdigital transducer (IP, IS) or a reflector (RS, RP), the actual values for metallization ratio or finger period correspond to the actual values of a periodically sampled continuous function.

26. Component according to any of the claims 1 through 25, in which a phase shift exists or a different finger period is set between two adjacent elements (selected from interdigital transducer and reflector) within an acoustic track, whereby the transition between the two elements is quasi-periodic.

27. Component according to any of the claims 1 through 26, in which the connection sequence of the electrode fingers to an interdigital transducer (IP, IS) is irregularly alternating and the interdigital transducer exhibits a withdrawal weighting.

28. Component according to any of the claims 1 through 27, in which the position of the transversal gap in one type of interdigital transducer (IP, IS) varies viewed over the length of the interdigital transducer.

29. Component according to any of the preceding claims, in which the size of the transversal gap in one type of interdigital transducer (IP, IS) varies viewed over the length of the interdigital transducer.

30. Component according to one of the claims 28 or 29, in which for the height g of the transversal gaps it is true that: $g \leq \lambda/4$.

31. Component according to any of the claims 1 through 30, in which the interdigital transducers (IP, IS) respectively belong to resonators that respectively exhibit a resonance frequency and an anti-resonance frequency , whereby the resonance frequency of the serial interdigital transducers (IS) lies in the range of the anti-resonance frequency of the parallel interdigital transducer (IP) or slightly above it.

32. Component according to any of the claims 1 through 31, in which the serial interdigital transducers (IS) are detuned against one another.

33. Component according to any of the claims 1 through 32, in which all apertures or overlappings of the electrode fingers are equal within an acoustic track.

34. Component according to any of the claims 1 through 33, in which the parallel interdigital transducers (IP) are detuned against one another.

35. Component according to any of the preceding claims, with a piezoelectric substrate that exhibits a surface aligned to crystal axes via suitable cut angles, said substrate being known for low losses given surface waves, Raleigh waves, shear waves, leak waves, BGS waves or HPVSAW.

36. Component according to any of the claims 1 through 35, in which the piezoelectric substrate comprises one of the materials $LiTaO_3$, $LiNbO_3$, quartz, langasite, langatate, $GaBO_4$, $Li_2B_4O_7$, langanite, $KnbO_3$ or GaAs.

37. Component according to any of the preceding claims, in which the piezoelectric substrate comprises a piezoelectric film that is applied on a carrier substrate.

38. Component according to any of the preceding claims, in which the piezoelectric film comprises $LiTaO_3$, $LiNbO_3$, AlN, ZnO or GaAs.

39. Component according to any of the preceding claims, in which the interdigital transducers (IP, IS), the reflectors (RS, RP) and the conductive structures connecting them in the circuiting are fashioned as metallic structures and are comprised of aluminum, an aluminum alloy or multilayer

structures, whereby the individual layers of the multilayer structure comprise one or more layers made from aluminum, an aluminum alloy or further metals such as Cu, Zr, Mg, Ti or Sc.

40. Component according to claim 39, in which the layer thicknesses h of the metallic structures are selected in the range of $1\% < h/\lambda < 15\%$.

41. Component according to claim 39 or 40, in which passivation layers are provided over the metallic structures.

42. Component according to any of the claims 1 through 41, in which the reference potential to which the at least one parallel branch is connected is a free-floating internal reference potential.